

Mach 6 Integrated Systems Tests of Lewis' Hypersonic Tunnel Facility



HTF steam ejector in operation during integrated systems testing.

A series of 15 integrated systems tests were conducted at the NASA Lewis Research Center's Hypersonic Tunnel Facility (HTF) with test conditions simulating flight up to Mach 6. Facility stagnation conditions up to 3050 °R and 1050 psia were obtained with typical test times of 20 to 45 sec.

The HTF is a free-jet, blowdown propulsion test facility that can simulate up to Mach 7 flight conditions with true air composition. Mach 5, 6, and 7 facility nozzles, each with a 42-in. exit diameter, are available. The facility, without modifications, can accommodate models approximately 10-ft long. Nitrogen is heated by a graphite core induction heater, and oxygen is added downstream to produce simulated air. The combination of clean-air, large scale, and Mach 7 capabilities is unique to the HTF.

The HTF was reactivated between 1990 and May 1994. This activity included refurbishing the graphite heater, the steam generation plant, the gaseous oxygen system, and all control systems. All systems were checked out and recertified, and environmental systems were upgraded to meet current standards. The data systems also were upgraded to current standards, and a communication link with NASA-wide computers was added.

In May 1994 a short-duration integrated systems test (approximately 2 sec) was conducted to verify facility operability. This test identified several modifications and corrections to the HTF that were required to improve overall facility performance. From the end of 1994 to April 1995, these modifications were completed, and the 3000-ft-long, 30-in.-diameter steam supply line was insulated to improve system efficiency and allow operation in all weather conditions. Through May 1995 the integrated systems were tested.

During this activity, significant test experience was gained, the graphite storage heater was

used at up to the maximum operating temperature of 5000 °R, several improvements were made to various facility systems and test procedures, and some operational problems experienced in the past were resolved (e.g., elimination of water backflow during shutdown). The HTF was operated with significant run times for the first time since being reactivated and for the first time in more than 20 years. Overall, this test program resulted in smooth, relatively trouble-free facility operation and served to successfully demonstrate the operating capability and reliability of the HTF.

Bibliography

Thomas, S.R.; Woike, M.R.; and Pack, W.D.: Mach 6 Integrated Systems Tests of the NASA Lewis Research Center Hypersonic Tunnel Facility. NASA TM-107083, 1996.